MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2300
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SRM Number: 3132
MSDS Number: 3132
SRM Name: Manganese Standard Solution

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Description: This Standard Reference Material (SRM) 3132 is intended for use as primary calibration standard for the quantitative determination of manganese. One unit of SRM 3132 consists of five 10 mL sealed borosilicate glass ampoules of an acidified aqueous solution prepared gravimetrically to contain a known mass fraction of manganese. The solution contains nitric acid at a volume fraction of approximately 10 %.

Substance: **Manganese Standard Solution (Manganese in 10 % Nitric Acid)**

Other Designations: **Manganese** (manganese metal; Mn) in **Nitric Acid** (aqua fortis; hydrogen nitrate; azotic acid; nitryl hydroxide); **Manganese Nitrate**[(a)] (manganese (2+) nitrate; manganese [II] nitrate; manganese dinitrate

[(a)] The addition of manganese to nitric acid forms manganese nitrate along with other intermediate chemical reactions.

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component	CAS Number	EC Number (EINECS)	Nominal Concentration (%)
Nitric Acid	7697-37-2	231-714-2	10 (by volume)
Manganese Nitrate	10377-66-9	233-828-8	< 3.26 (by mass)
Manganese	7439-96-5	231-105-1	1 (by mass)

EC Classification (assigned): **Manganese, Manganese Nitrate Solution**
Not determined.

Nitric Acid Solution: 5% ≤ C < 20 % (C = concentration)
C

Danger Hazard Symbol: **Nitric Acid Solution: 5% ≤ C < 20 %**
C

EC Risk: **Nitric Acid Solution: 5% ≤ C < 20 %**
R34

EC Safety: **Manganese, Nitric Acid Solution**
S1, S2, S23, S26, S36, S45

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0–4): Health = 3 Fire = 0 Reactivity = 0

Major Health Hazards: Respiratory tract, mucous membrane, skin, and eye burns.

Potential Health Effects

Inhalation: **Nitric Acid:** Corrosive. Effects should be less severe than from exposure to higher concentrations of nitric acid where exposure may cause respiratory irritation with coughing, choking, and burns of the mucous membranes.

Skin Contact: **Nitric Acid:** Corrosive. Effects should be less severe than from exposure to higher concentrations of nitric acid where exposure may cause pain and severe burns to the skin. Dilute solutions of nitric acid may cause mild irritation and harden the epidermis.

Manganese, Manganese Nitrate: Solutions of manganese nitrate may be corrosive and may cause dermatitis.

Eye Contact: **Nitric Acid:** Corrosive. Effects should be less severe than from exposure to higher concentrations of nitric acid where exposure may cause pain, lacrimation, photophobia, and severe burns to the eye.

Manganese Nitrate: Solutions may cause irritation.

Ingestion: **Manganese, Manganese Nitrate, Nitric Acid:** Ingestion of large doses of manganese or manganese compounds may cause gastrointestinal irritation and possible systemic toxicity. Chronic exposure of manganese has produced lethargy, edema, and decreased movement of the eyes and eyelids. Nitric acid is corrosive. Effects should be less severe than from exposure to higher concentrations of nitric acid where exposure may cause severe burns of the mucous membranes of the mouth, throat, and esophagus. Symptoms due to exposure of nitric acid include immediate pain, difficulty or inability to swallow or speak, marked thirst, nausea, vomiting, and diarrhea.

Listed as a Carcinogen/ Potential Carcinogen:

Yes	No	
____	X	In the National Toxicology Program (NTP) Report on Carcinogens.
____	X	In the International Agency for Research on Cancer (IARC) Monographs.
____	X	By the Occupational Safety and Health Administration (OSHA).

4. FIRST AID MEASURES

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration by qualified personnel. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention if necessary.

Eye Contact: Flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Get immediate medical attention.

Ingestion: If a large amount is swallowed, get immediate medical attention. **DO NOT** induce vomiting.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Manganese Standard Solution is a negligible fire hazard.

Extinguishing Media: Use regular dry chemical, carbon dioxide, water or any means suitable for extinguishing surrounding fire.

Fire Fighting: Move container from fire area if possible without exposure to risk. Avoid inhalation of material or combustion by-products. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point:	Not available.
Method Used:	Not available.
Autoignition Temperature:	Not available.
Flammability Limits in Air	
Upper (Volume %):	Not available.
Lower (Volume %):	Not available.

6. ACCIDENTAL RELEASE MEASURES

Occupational Release:	**DO NOT** touch material. Collect the material in an appropriate container for disposal.
Disposal:	See Section 13, "Disposal Considerations".

7. HANDLING AND STORAGE

Storage:	Store and handle in accordance with all current regulations and standards. Keep separated from incompatible substances.
Safe Handling Precautions:	See Section 8, "Exposure Controls and Personal Protection".

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits:

Nitric Acid
OSHA: 5 mg/ m^3 (2 ppm) TWA
ACGIH (TLV): 5 mg/ m^3 (2 ppm) TWA
NIOSH: 5 mg/m^3 (2 ppm) recommended TWA (10 h)
WEL UK: 5.2 mg/m^3 (2 ppm) TWA

Manganese and Manganese Compounds (as Mn)
OSHA: 5 mg/m^3 ceiling (metal, fume, compounds)
ACHIG (TLV): 0.2 mg/m^3 TWA (metal and inorganic compounds)
NIOSH: 1 mg/m^3 recommended TWA (10 h) (metal, fume, compounds)
NIOSH: 3 mg/m^3 recommended STEL (metal, fume, compounds)

Ventilation:	Use a local exhaust ventilation system. Ensure compliance with applicable exposure limits.
Eye Protection:	Wear safety goggles. An eye wash station should be readily available near areas of use.
Personal Protections:	Wear appropriate chemical resistant clothing and gloves to prevent skin exposure.

9. PHYSICAL AND CHEMICAL PROPERTIES

Component:	**Manganese Standard Solution**
Appearance and Odor:	Liquid. Irritating odor.
Density:	Not available.

10. STABILITY AND REACTIVITY

Stability: X Stable ___ Unstable

Stable at normal temperatures and pressure.

Conditions to Avoid:	Avoid contact with incompatible and combustible materials.
Incompatible Materials:	Acids. Halogens. Combustible materials. Oxidizing materials. Metals. Bases. Metal Salts. Metal Oxides. Reducing agents. Cyanides. Peroxides.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Thermal decomposition may produce oxides of nitrogen and manganese.

Hazardous Polymerization: ___ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: X Inhalation X Skin X Ingestion

Toxicity Data:

Nitric Acid
Human, Oral LD_{LO}: 430 mg/kg
Rat, Inhalation LC_{50}: 260 mg/m^3 (30 min)
Rat, Skin TD_{LO}: 150 ml/kg

Manganese
Man, Inhalation TC_{LO}: 2 300 μg/m^3
Rat, Oral LD_{50}: 9 g/kg

Manganese Nitrate
Mouse, Intraperitoneal LD_{50}: 56 mg/kg

Reproductive, Tumorigenic, Mutagenic Data:

Nitric Acid: Nitric acid has been investigated as a reproductive effector.

Manganese: Manganese has been investigated as a reproductive, mutagenic, and tumorigenic effector.

Manganese Nitrate: Manganese nitrate has been investigated as a mutagenic effector.

Medical Conditions Aggravated by Exposure:

Nitric Acid: Eye, respiratory, and skin disorders. Allergies.
Manganese and Manganese Nitrate: History of alcoholism. Blood system disorders. Liver disorders. Nervous system disorders. Respiratory disorders.

Health Effects (Acute and Chronic): See Section 3, "Hazards Identification".

12. ECOLOGICAL INFORMATION

Ecotoxicity: Moderately toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose in accordance with federal, state, and local regulations.

14. TRANSPORTATION INFORMATION

U.S. DOT & IATA: Nitric acid, solution; Hazard Class 8; UN2031; Packing Group II; Excepted quantity (10 mL × 5 ampoules).

15. REGULATORY INFORMATION

U.S. Regulations: CERCLA Sections 102a/103 (40 CFR 302.4): Nitric Acid: 1000 lbs RQ; Manganese Nitrate and Manganese: Not regulated

SARA Title III Section 302 (40 CFR 355.30): Nitric Acid: 1000 lbs TPQ; Manganese Nitrate and Manganese: not regulated.

SARA Title III Section 304 (40 CFR 355.40): Nitric Acid: 1000 lbs RQ; Manganese Nitrate and Manganese: not regulated.

SARA Title III, Section 313 (40 CFR 372.65): Manganese and Compounds (as MN). Nitric Acid.

OSHA Process Safety (29 CFR 1910.119): Nitric Acid: 500 lbs TQ (≥ 94.5 % by weight). Manganese Nitrate and Manganese: not regulated.

California Proposition 65: Manganese, Manganese Nitrate and Nitric acid are not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE:	Yes.
CHRONIC:	Yes.
FIRE:	No.
REACTIVE:	No.
SUDDEN RELEASE:	No.

CANADIAN Regulations: WHMIS Classification: Not determined.

National Inventory Status: U.S. Inventory (TSCA): Manganese, Manganese Nitrate, and Nitric Acid are listed on inventory.

TSCA 12b Export Notification: Not listed.

EC Classification: **Nitric Acid Solution: 5% ≤ C < 20 % (C = concentration)**
C Corrosive

Danger/Hazard Symbol: **Nitric Acid Solution: 5% ≤ C < 20 %**
C Corrosive

EC Risk Phrases: **Nitric Acid Solution: 5% ≤ C < 20 %**
R34 Causes burns.

EC Safety Phrases: **Mercuric Nitrate, Mercury, Nitric Acid**

S1/2	Keep locked-up and out of the reach of children.
S23	DO NOT breathe gas, fumes, vapor, or spray.
S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S36	Wear suitable protective clothing.
S45	In case of accident or if you feel unwell, seek medical advice immediately.

16. OTHER INFORMATION

Sources: MDL Information Systems, Inc., MSDS *Manganese*, 16 June 2005.
MDL Information Systems, Inc. MSDS *Manganese Nitrate*, 16 March 2006.
MDL Information Systems, Inc. MSDS *Manganese Nitrate Solution*, 16 June 2005.
MDL Information Systems, Inc. MSDS *Nitric Acid*, 16 March 2006.